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THE PREPARATION OF POTTING SOIL, COMPOST, AND ARTIFICIAL MANURE

by

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Potting Soil

Potting or seedbed soil for the starting of seedlings and the growing of plants should be of medium texture. One that is too sandy dries out quickly and seldom yields vigorous, stocky plants. On the other hand, one that is clayey is inclined to be cold and to bake, thereby preventing quick germination and satisfactory emergence of the seedlings. For most purposes a seedbed soil should be of a friable, loamy, character, free from lumps, stones, sticks, or other coarse foreign matter. Moreover, it must have sufficient plant nutrient in a readily available form to supply the developing seedlings with the nourishment they need.

Topsoil from a fertile cultivated field often makes an ideal base for a potting soil. It must have the proper physical characteristics and it always requires a certain amount of improvement through the addition of manure and fertilizer, and sometimes soil amendments, such as ground limestone. Topsoil from fields previously devoted to intensive, high fertilized crops is likely to be quite satisfactory with a minimum amount of modification. Clover or alfalfa field soil usually makes another satisfactory source of raw material for the preparation of potting or seedbed soil. Whatever the source, close attention should be paid to the physical character of the soil and it should invariably come from a source known to be fertile. Many make the error of selecting land that merely is dark colored, thinking that it must of necessity be fertile. Such is not always the case.

A good seedbed or potting soil can usually be prepared by starting with a clay loam to which about a fourth by volume of decayed cattle manure or a sixth by volume of dried stockyard manure is added and thoroughly mixed to insure uniform distribution. In addition to the manure, two to three pounds of 20 percent superphosphate and five to six pounds of ground dolomitic limestone should be added to each ton of the manure-soil mixture. If the soil used is not fertile, or if an especially rich seedbed or potting soil is desired, it may be advisable to add two or three pounds of a mixed fertilizer. It is usually best not to make the whole lot too rich, but later on to add fertilizer to portions used for specific uses where more fertility is demanded.

The best material is that prepared several months in advance of the time it is to be used. Mixing a time or two during this period is very desirable.

When heavy-texture topsoil is used in the preparation, it may be desirable to incorporate some sand in the mixture. Likewise, in the case of light-textured soil some heavier-texture material should be mixed in. The experienced gardener soon learns the characteristics of the material he is using and easily determines the treatment necessary to produce the type of soil he needs. Most seeds and plants start and thrive under moderately acid conditions. Caution must be used in regard to using too much limes. A distinctly alkaline reaction should be avoided. It is usually best to use ground dolomitic limestone instead of high calcium material. The dolomitic type supplies both calcium and magnesium and it is less likely to interfere with other elements in the soil. The use of burned lime in potting and seedbed soil is undesirable.

In the making of potting and seedbed soil care should be exercised to see that the materials used are free from insects and injurious disease organisms. Manure should not contain any plant remains that are likely to transmit diseases to the garden. Irrespective of the source of the materials used, it is wise to sterilize seedbed and potting soil before use if there is reason to suspect that it contains harmful insects or disease-producing agents. In a small way this can be accomplished by placing the soil in a pan and baking it for an hour in an oven at a temperature of about 210° or 215° Fahrenheit. This treatment not only controls most diseases that might be present, but it also kills insects and many weed seeds. Another way to accomplish the same result is to place the soil in a home canning retort and to steam sterilize it for an hour at a pressure of about 15 pounds. In a large way, soil may be sterilized by the use of the steam pan or other similar methods. Complete information on this and other methods of soil sterilization may be obtained from Farmers' Bulletin 1629, "Steam Sterilization of Soil for Tobacco and Other Crops".

The chemical sterilization of soil by the use of formaldehyde, chloropicrin (tear gas), Dowfume-W, DD, or Iscobrome is extensively practiced. One method is to apply a formaldehyde solution of 1 gallon of commercial (37 percent) formaldehyde in 30 gallons of water to the seedbed at the rate of 1 quart to each square foot of soil. The soil should be fairly moist and in a loose friable condition before the solution is applied. After the solution is applied the soil is watered heavily and kept covered for 48 hours; then the covers are removed, and the gas is allowed to escape. As soon as the soil is sufficiently dry, it should be worked to hasten the escape of the formaldehyde vapor. The soil must be allowed to stand 10 days to 2 weeks before planting, and formaldehyde must never be used where the vapor will reach plants, for they would be injured or killed by the gas.

The other materials are liquid chemicals which have come into use as soil disinfectants. They have proved generally effective in destroying pathogenic fungi, bacteria, and nematodes, also soil insects. These chemicals which are sold under trade names are usually applied by means of devices especially designed by the manufacturers for injecting the chemicals into the soil.

Manufacturers' directions should be carefully followed. The cylinder should be taken outdoors when the injector is filled. Care should be taken not to spill even small amounts of these liquids on the hands or clothing.

The gas from chloropicrin, Dowfume-W, and DD is very poisonous to plants, and soil should never be treated where the fumes will reach plants in the vicinity. Plants should not be set in the treated soil until the odor of the gas can be no longer detected. This may take from 5 to 20 days, depending on the temperature and moisture content of the soil. The gas escapes more rapidly when the soil temperatures are high. Spading or working the soil about 4 days after treatment will hasten the escape of the gas. Iscobrome can be used safely with good ventilation in the presence of living plants and treated soil may be safely planted within about 5 to 10 days.

Compost

As generally understood in America the term "compost" means a well decomposed mixture of manure, sods, leafmold, peat, or other organic matter and soil, sand, or similar materials. Chemical fertilizers may or may not be added to the mixture. It is usually prepared several months before needed and differs from seedbed and potting soil, as discussed in another portion of this circular, mainly in that it contains a higher proportion of organic matter and fertilizing constituents. Compost is more desirable than manure for a number of reasons, chiefly because it renders the materials in a more available condition for the growth of plants. Its use is a measure of economy because plant remains that are unsuitable for direct application to the soil may be decomposed by composting and made suitable for plant production.

At least some manure is desirable in all composts. Experienced gardeners prefer cattle manure, but horse manure is also quite satisfactory. Many gardeners keep chickens, and a careful handling of the cleanings from the poultry house will accomplish surprising results if composted and used in the vegetable garden. The cleanings from a house containing 50 chickens will, if properly handled, supply all the manure that is needed for a moderate-sized garden. Dried pulverized cattle manure may be employed in the absence of less expensive materials for the preparation of compost. This material contains but little moisture whereas fresh manure may have as much as 80 percent moisture. Smaller quantities of dried manure may therefore be used, and its use is entirely practical. Dried sheep manure may be used in the same way. Hardwood leaves, straw, or other remains that are disease-free may be used in making compost. If piled and turned from time to time with occasional wetting, these materials may soon be decomposed to a suitable stage for the making of compost. The use of 6 or 8 pounds of ammonium sulphate, 2 or 3 pounds of superphosphate, and 6 or 8 pounds of ground dolomitic limestone to each half ton of these materials will materially hasten the decomposition. If dry material is used the quantity of ammonium sulphate should be raised to 20 to 30 pounds for each half ton of material.

Compost should be prepared in some out-of-the-way place where water can be obtained for wetting it down. It is well to select a depression where loss from leaching cannot occur. Pile the materials in layers in the proportions of about 1 part fresh cattle or horse manure or decayed plant remains to 2 parts soil, preferably a grass sod. With dried cattle or sheep manure or poultry manure, the proportions should be 1 part manure to 6 to 7 parts sod or soil. These manures are very dry and they will not decompose properly unless kept quite moist. The thickest layer should be only 6 or 7 inches thick, and the pile may be as large and as high as needed to give the desired quantity. It may be in the form of a rick 5 or 6 feet high, and in that case there should be a trough or depression on the top to catch and hold rain water or water applied through the hose. A compost pile should never be allowed to dry out. The pile should be sliced down, turned two or three times, and well moistened at 3 to 4-week intervals during the course of the 5 or 6 months needed to make the compost. A compost pile made during the late summer and turned at intervals during fall and winter should be in good condition for use during the following spring. Compost of the character described may be used in reasonable quantities either as a top dressing in the hills, or under the rows of almost all vegetable crops.

Artificial Manures

Artificial manure prepared from straw, leaves, grass, weeds or many other vegetable materials often offers a solution to the vexatious problem created by the scarcity of animal manure. Tests at a number of the State experiment stations have shown that the synthetic manure may be prepared at reasonable cost and that it is equal in value to the natural manure.

Materials needed for the preparation of the synthetic, or artificial manure include the vegetable matter, which may consist of straw, hay, grass, weeds, etc., either green or dry (care being taken to avoid diseased material), and chemicals to aid in the decomposition and to add fertility to the end product. A chemical formula ordinarily recommended consists of:

Ammonium sulphate (20% nitrogen)	45 parts by weight
Superphosphate (20%)	15 parts by weight
Ground dolomitic limestone	40 parts by weight

One hundred and fifty pounds of this mixture is used with each ton of dry vegetable matter. When green material such as grass or weeds is used, three tons of this corresponds roughly to one ton of dry material. It is not necessary to be exact in the proportions of vegetable matter and chemicals. If less of the chemicals is used the decomposition rate is likely to be slower. However, by keeping the pile wet and mixing it now and then, the rate of decay can be hastened. On the other hand there is no advantage in using more chemical material than indicated. It does not hasten decomposition and there is likely to be actual loss of nitrogen. Lime is very important as it counteracts acidity, thereby establishing conditions favorable for bacterial activity.

Synthetic manure may be prepared in any quantity. For convenience the figures given in this circular are for one ton of dry material but there is no reason whatever why anyone who has a few hundred pounds of vegetable material should not use it for making artificial manure by mixing the proper proportion of vegetable matter and chemicals. The site for the work naturally depends on the quantity of material to be handled. The home gardener who has 500 pounds of dry grass or fifteen hundred pounds of green ragweed, daisies, etc., will need only a small depression in the rear of his garden or a corner of the yard. It is well to select a site where leaching will not be excessive. The method is simple; merely spread a layer of the vegetable material a few inches thick using about a fourth of the material. Then sprinkle on a fourth of the quantity of the chemical mixture and wet down lightly but not enough to wash the chemicals away. Continue until the material has all been used and a flattopped pile has been constructed. The addition of some fertile topsoil to each layer encourages more rapid bacterial action. The pile should be slightly hollow on top so it will catch and hold the rain. This table gives the approximate quantities of the chemical mixture to use for different amounts of dry and green material:

	For 500 lbs. vege. material	For 1000 lbs. vege. material	For 1500 lbs. vege. material	For 1 ton vege. material
Pounds of chemicals for dry material	37.5	75	112.5	150
Pounds of chemicals for green material	12.5	25	37.5	50

It is not desirable to trample or otherwise pack the pile as it is being built. Looseness allows oxygen to enter and stimulates decomposition. Frequent watering to keep the pile moist is desirable but flooding interferes with bacterial action and leaches plant food away. Under very favorable conditions as little as six weeks are required to secure decomposition of the material but much longer periods up to 6 months or more, are often needed to obtain satisfactory results. Experiments show that one ton of dry straw, or equivalent, will yield about two and one-half tons of moist manure, and that the synthetic manure does not vary greatly in composition from average farm manure. Field experiments have shown that it also gives crop responses equal to average grade farm manure. It may be used in the preparation of compost or for any other purpose where animal manure is adapted. It does give an opportunity for the utilization of crop wastes, converting them to the type of material that it is most difficult for gardeners and home owners to obtain. It is a tragic mistake to burn or destroy garden refuse.

The importance of organic matter, particularly in home gardening, in truck crop production, in establishing and maintaining lawns, and in the care of ornamentals around the home, is difficult to overestimate. This, however, does not justify the extravagant claims made by some to the effect that it is a substitute for commercial fertilizer or that its use makes it unnecessary to use either fungicides or insecticides. Organic matter is highly desirable in the production of crops in soil but supplementary fertilization and insect and disease control are also usually required. Statements and beliefs otherwise are not based on a complete understanding of the problems that are ordinarily involved in crop production.